

13

n-channel type TFT. In addition, the first impurity region formed in the semiconductor layer through the gate insulating film and the region in which the second gate electrode is adjacent to the gate insulating film are formed one over another by self-alignment. On the other hand, in the p-channel type TFT, the source region and the drain regions partly overlap with the second gate electrode. However, this poses no practical problem. Also, it is needless to say that reference numerals **7033**, **7037**, **7041** and **7045** denote channel regions. Reference numeral **7048** denotes a low concentration impurity region.

After the step of FIG. **10D** has been completed, the first interlayer insulating film **7049** (1000 nm thick) is formed. The first interlayer insulating film **7049** may be silicon oxide film, silicon nitride film, silicon nitride oxide film, organic resin film, or a laminate thereof. In this example (although not shown), a 50-nm thick silicon nitride film is formed and then a 950-nm thick silicon oxide film is formed, so that a two layer structure is obtained.

The first interlayer insulating film **7049** undergoes patterning so that contact holes are formed in the source region and drain region of TFT. Subsequently, the source electrodes (**7050**, **7052** and **7053**) and the drain electrodes (**7051** and **7054**) are formed. In this example (although not shown), this electrode is formed by patterning from a three layer film composed of titanium film (100 nm thick), titanium-containing aluminum film (300 nm thick), and titanium film (150 nm thick) which are formed consecutively by sputtering.

In this way the CMOS circuit and active matrix circuit are formed on the substrate **7001**, as shown in FIG. **10E**. At the same time, the storage capacitor is formed at the drain side of the n-channel type TFT of the active matrix circuit. The active matrix substrate is formed as mentioned above.

Now, the CMOS circuit and the active matrix circuit formed on the same substrate as mentioned above are used to form the LCD panel. This step will be explained below with reference to FIGS. **11A** and **11B**. First, on the substrate shown in FIG. **10E** are formed the source electrodes (**7050**, **7052** and **7053**), the drain electrodes (**7051** and **7054**), and the passivation film **7055** covering the first interlayer insulating film **7049**. The passivation film **7055** is a 50-nm thick silicon nitride film. The passivation film **7055** is covered with a second interlayer insulating film **7056** which is about 1000 nm thick and is formed from an organic resin. Examples of the organic resin include polyimide, acryl, and polyimideamide. The organic resin film is easy to form, decreases the parasitic capacity because of its low dielectric constant, and has a smooth surface. Other organic resin film than mentioned above may be used. In this example, a polyimide film capable of thermal polymerization after application onto the substrate is used. It is baked at 300° C. after coating.

Second, the light screening layer **7057** is formed in part of the pixel region of the second inter layer insulating film **7056**. The light screening layer **7057** may be a metal film or a film formed from an organic resin containing a pigment. In this example, it is formed from titanium by sputtering.

Then, the third interlayer insulating film **7058** is formed from an organic resin, like the second interlayer insulating film **7056**. Between the second interlayer insulating film **7056** and the third interlayer insulating film **7058** is formed a contact hole reaching the drain electrode **7054**, and then the pixel electrode **7059** is formed. The pixel electrode **7059** may be a transparent conductive film (in the case of a liquid crystal display unit of transmission type) or a metal film (in

14

the case of a liquid crystal display unit of reflection type). In this example, the pixel electrode **7059** is a 100 nm thick ITO (indium-tin oxide) film which is formed by sputtering.

After the step shown in FIG. **11A** is completed, an alignment layer **7060** is formed. The alignment layer for the ordinary liquid-crystal display element is usually made of polyimide resin. On the opposing substrate **7071** are formed the opposing electrode **7072** and the alignment layer **7073**. The alignment layer **7073** undergoes rubbing so that the liquid crystal molecules are oriented parallel at a prescribed pretilt angle.

The substrate (on which are formed the active matrix circuit and the CMOS circuit) and the opposing substrate are assembled into a cell in the usual way, with a sealing material and a spacer interposed between them (not shown). The space between the two substrates is filled with the liquid crystal material **7074** and sealed completely with a sealing material (not shown). Thus, the LCD panel as shown in FIG. **11B** is completed.

EXAMPLE 4

This example demonstrates, with reference to FIGS. **12A** and **12B**, a keyboardless information terminal which is provided with the information-processing device according to Example 1 or 2.

There is shown in FIG. **12A** an information terminal **2000** with communication functions (such as WWW browsing and electronic mailing) which is provided with a digital camera **2001**. It employs the information-processing device of the present invention.

There is shown in FIG. **12B** an electronic note **2100** with communication functions. It employs the information-processing device of the present invention.

The information-processing device of the present invention has a touch panel which permits input through the optical guide plate. Therefore, it is simple in structure and superior in shock resistance. It is suitable for the portable information terminal as shown in FIGS. **12A** and **12B**.

The information-processing device of the present invention may be applied not only to the information terminal shown in FIGS. **12A** and **12B** but also to electronic machines and equipment of all kinds with touch panels, such as ticket vending machines, automatic teller machines (ATM), and office machines (such as facsimile and copier).

EXAMPLE 5

The information-processing device in Examples 1 to 4 mentioned above employs as the display unit an LCD panel with nematic liquid crystal. However, this display unit may be replaced by that of different kind which employs a display medium which changes in optical properties in response to the voltage applied. For example, it is possible to use a ferroelectric liquid crystal or antiferroelectric liquid crystal. It is also possible to use an organic EL (electroluminescent) panel.

The information-processing device of the present invention employs an LCD panel of field sequential drive system, so that it permits high-precision display. Therefore, the user can confirm the display on the LCD panel and enter information through the touch panel by accurately touching the desired point, without the possibility of making an input miss.

What is claimed is:

1. An information-processing device comprising:
a field sequential display unit having a back light to supply three-color light and an image display part